

A comprehensive dated phylogeny of China's vascular plants reveals a hidden global biodiversity hotspot

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Supplementary Discussion

Phylogenetic relationships

The relationships among major clades in our phylogenetic tree were largely stable, with most orders exhibiting moderate to strong bootstrap (BS) support exceeding 70% (Fig. 1). Exceptions occurred primarily within superasterids and superrosids, including orders such as Rosales and Fabales. Key distinctions emerged when comparing our results to those of Hu *et al.*¹. Most notably, gymnosperms formed a strongly supported monophyletic group (Pinales-Gnetales-Ephedrales clade, BS = 100%) sister to angiosperms in our phylogeny (Fig. 1), whereas the clade including Gnetales and Ephedrales was sister to the remaining seed plants (BS = 84%) in Hu *et al.*¹. This discrepancy is likely attributable to our expanded taxon sampling of both gymnosperms and angiosperms and aligns with recent large-scale phylogenomic analyses^{2,3}.

Within angiosperms, six families were resolved as non-monophyletic: Aristolochiaceae, Burmanniaceae, Dioscoreaceae, Dipterocarpaceae, Ericaceae, and Olacaceae *s.l.*. The non-monophyly of Ericaceae arose from the placement of Mitrastemonaceae, a family newly sampled in this study, which was nested within Monotropeae. Our phylogeny identified 692 (21.0%) non-monophyletic genera (Supplementary Data 7), a proportion consistent with expectations for large-scale phylogenies. Most of the newly sampled genera occupied systematic positions congruent with published molecular studies, though four genera in Brassicaceae (*Dipoma*, *Hemilophia*, *Macropodium*, and *Pseudoclausia*) showed conflicting placements (see Supplementary Table 9 for details). The parasitic genus *Cynomorium* was excluded from downstream analyses due to phylogenetic instability, likely attributable to its extensive loss of plastid genes and specialized lifestyle⁴.

Supplementary Note

Geographic delineation of the newly proposed hotspot

We delineated the boundaries of the proposed Central China hotspot according to taxonomic endemism centres at the genus and species levels, using quartile-based and temporal threshold approaches (Fig. 3a, b and Extended Data Fig. 8e, f). These boundaries were further refined with reference to previous studies on climate, vegetation, and floristic regionalization. The newly proposed hotspot aligns with Takhtajan's Central China Floristic Province⁵ and is defined by several key geographic features: the eastern coast to the east, the southern boundary of central subtropical vegetation zone to the south, the eastern edge of Hengduan Mountains to the west, and the boundary between the subtropical and warm temperate zones to the north.

The southern boundary corresponds to the division between the central and southern subtropical zones, as proposed in *Vegetation of China*⁶. It runs along the southern margin of the Nanling Mountains and the Guizhou Plateau, extending north of the Tropic of Cancer. This boundary was also adjusted to avoid overlap with the northern extent of the Indo-Burma hotspot (Extended Data Fig. 2). This marks the northern distributional limits of several tropical families (e.g., Clusiaceae, Annonaceae, Myrtaceae)⁷, as the northward dispersal of tropical-affinity lineages diminishes substantially here.

The western boundary coincides with the eastern edge of the recognized Mountains of Southwest China hotspot. Areas to the east are characterized by subtropical evergreen broad-leaved forests experiencing a subtropical monsoon climate, whereas areas to the west lie within the Qinghai-Tibet Plateau, which is marked by temperate alpine climates and distinct vegetation and community assemblages.

The northern boundary is defined by the Qinling–Huai River line, which traces the climatic limit of the subtropical zone and coincides with the northern extent of East Asian subtropical evergreen broad-leaved forests. This transitional zone forms China's principal geographic north-south divide, sharply separating temperate deciduous broad-

leaved forests to the north from subtropical ecosystems to the south, a contrast reflected in climate, vegetation, and floristic composition.

In summary, the Central China region defined in this study encompasses the core of the East Asian subtropical evergreen broad-leaved forests. It is strongly influenced by the monsoon climate and is floristically distinct from adjacent biogeographic units, representing a relatively independent biogeographic region that is globally rare at this latitude⁸.

Endemism assessment of the newly proposed hotspot

To rigorously evaluate Central China's qualification as a global biodiversity hotspot under the criterion of > 1,500 endemic vascular plant species⁹, we compiled an updated regional checklist through a two-phase process. First, we intersected our 100 km × 100 km grid layer with the Central China boundary, identifying 182 grid cells. From China's endemic vascular plant distribution dataset, we extracted species with ≥ 90% of their range confined to these Central China grid cells¹⁰, yielding a preliminary checklist of 1,633 endemic species. Recognizing limitations in our primary dataset, derived mainly from *Flora of China* and lacking recent taxa and taxonomic updates, we supplemented it using the *Catalogue of Life China* (Species 2000 China Node, <http://www.sp2000.org.cn/>). We standardized taxonomic names and identified provincial distributions for 2,216 endemic Chinese vascular plant species absent from our grid distribution dataset. Then we excluded species occurring only in provinces entirely outside Central China. We further manually verified for species in provinces overlapping Central China's boundary (e.g., Guangdong, Guangxi, Sichuan) due to high endemism in these transition zones, retaining only species with ≥ 90% of their range within Central China. This added 391 validated species to the preliminary checklist, resulting in a final confirmed list of 2,024 endemic vascular plant species for Central China. Given our stringent ≥ 90% range thresholds and ongoing discovery of new species¹¹, this estimate is likely conservative. At higher taxonomic levels, we identified 43 endemic genera (including *Metasequoia* and *Davidia*) and two endemic

families (Ginkgoaceae and Eucommiaceae) applying similar validation workflows.

To account for the potential overestimation of species ranges caused by the use of county-level distribution data, we conducted a sensitivity analysis based on occurrence records from the Global Biodiversity Information Facility (GBIF, <https://www.gbif.org/>). Specifically, we downloaded all available GBIF occurrence records for vascular plants in China (5,899,244 records)¹² and standardized taxonomic names using the U.taxonstand¹³ package following the *Catalogue of Life China*. We then identified and removed suspect records using the CoordinateCleaner¹⁴ package, which flags common errors in large biodiversity databases, including identical latitude and longitude values, zero coordinates, points falling in the open ocean, at country centroids, or at major biodiversity institutions, as well as spatial outliers. To further reduce the influence of non-native species, we removed occurrences flagged as non-native based on Kew's Plants of the World database (POWO, <https://powo.science.kew.org/>), using the rWCVP¹⁵ package. After matching the cleaned records to our list of Chinese endemic vascular plant species, we retained 12,973 endemic species (81.4% of all Chinese endemics) represented by 432,834 occurrence records.

Following Carta *et al.*¹⁶, we estimated species ranges by modelling occurrence points using hull geometries. Species with ≥ 6 unique occurrences (7,312 species) were modeled using alpha hulls, generated with the *getDynamicAlphaHull* function in the rangeBuilder¹⁷ package, starting with an initial α of 2 and iteratively adjusting it to ensure that at least 95% of points fell within the estimated polygon. Species with 3–5 unique occurrences (2,308 species) were modeled using convex hulls, whereas species with only 1–2 occurrences (3,353 species) were assigned a 10-km buffer to conservatively account for potential spatial uncertainties. We then projected all ranges onto an equal-area Albers grid (10 km \times 10 km) to extract species occurrences for spatial analyses. The resulting endemism patterns were broadly consistent with those based on county-level data and the 100 km \times 100 km grid (Supplementary Fig. 4), with

endemic species concentrated in southern China and with two prominent endemism centres: the Hengduan Mountains and Central China.

To further validate the number of vascular plant endemics in Central China, we intersected the newly generated range polygons for the 12,973 endemic species with the geographic extent of Central China. Species whose ranges overlapped $> 90\%$ with this region were classified as Central China endemics, resulting in 1,675 species. However, nearly 3,000 Chinese endemic species lacked usable GBIF records, many of which are rare or have extremely small populations. Using the same approach applied to county-level data, we identified an additional 485 Central China endemics not represented in GBIF. The resulting total of 2,158 endemics inferred from this parallel analysis is broadly consistent with our county-level estimates.

Due to relatively limited availability of vertebrate distribution data, we compiled Central China's endemic vertebrate checklist primarily using province-level records from the *Catalogue of Life China* (Species 2000 China Node, <http://www.sp2000.org.cn/>). First, we extracted candidate endemic species from the Red List of China's Vertebrates¹⁸, then applied the same $\geq 90\%$ range confinement filtering and manual verification procedures used for vascular plants. This yielded a final dataset of 248 endemic vertebrate species such as *Rhinopithecus brelichi* and *Alligator sinensis*, eight endemic genera (e.g., *Linichthys*, *Liua*), and one endemic family (Lipotidae) in Central China. To further assess Central China's status as a global biodiversity hotspot, we compared its biome characteristics, area size, and vascular plant diversity against established subtropical hotspots across both hemispheres.

Evaluation of vegetation loss in the newly proposed hotspot

Central China has experienced prolonged human influence, among the earliest regions in China to be settled, and remains densely populated today^{19,20}. This history has severely degraded native vegetation, leaving fragmented remnants⁶. To quantify the extent of transformation from primary vegetation to altered landscapes, we classified areas as modified if they were converted to urban or agricultural land, or exhibited

compositional/structural deviation from reference conditions, following the criteria outlined by Noss *et al.*¹⁰.

According to China's vegetation regionalization^{6,21}, Central China lies entirely in mid- and north-subtropical zones, where the natural vegetation is dominated by evergreen broad-leaved forests, interspersed with smaller areas of deciduous broad-leaved forests, coniferous forests, and mixed forests. Using a recently updated vegetation map of China (1:1000000)²², we extracted the vegetation distribution across Central China (total area: 1,541,960 km²), encompassing ten major vegetation type groups (e.g., cultivated vegetation, coniferous forest, broad-leaved forest, and scrub). We assessed vegetation modification in Central China using a three-step approach:

1. Exclusion of urban and agricultural areas: We first excluded areas classified as cultivated vegetation and non-vegetated zones. These have been predominantly converted for human use and are considered entirely devoid of natural vegetation.

2. Identification of highly altered secondary vegetation: We quantified the area classified as scrub, meadow, and other secondary vegetation types resulting primarily from forest degradation. Due to irreversible historical human impacts on soil and hydrology, restoration of these areas to natural climax vegetation is unlikely.

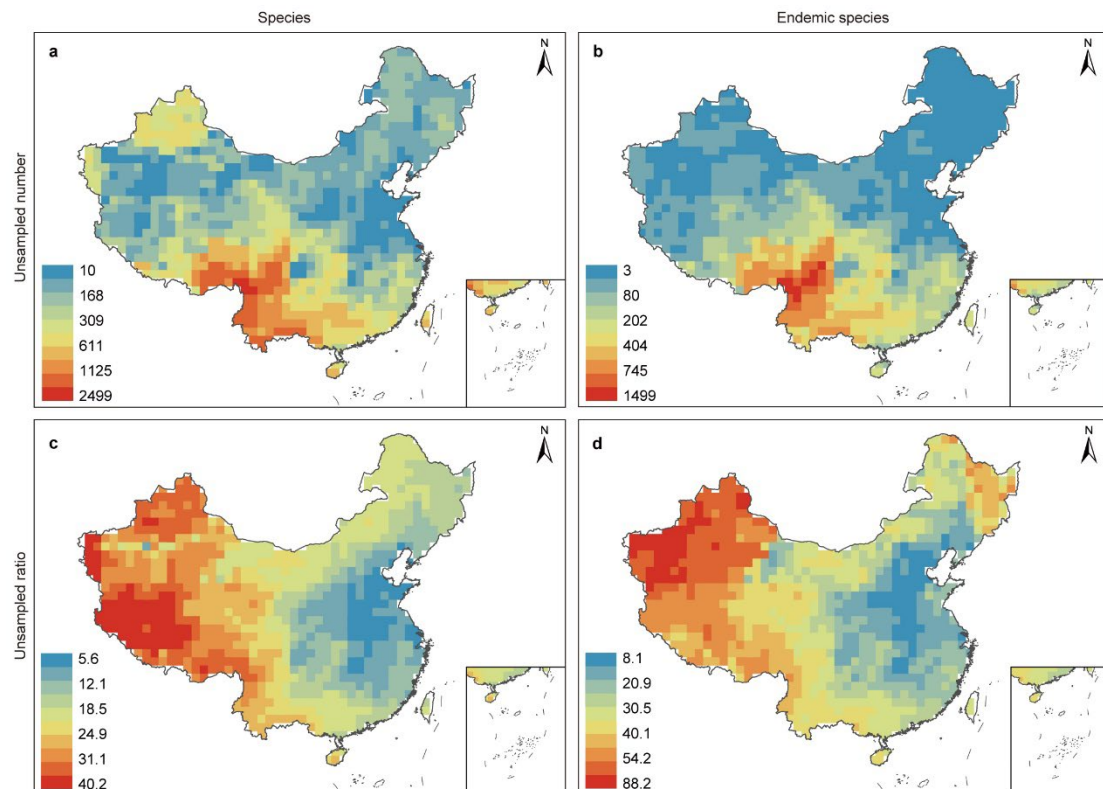
3. Distinguishing planted from natural forests: Given the significant structural, compositional, and biodiversity differences between plantations and natural forests and considering China's status as having the world's largest plantation area²³, we incorporated this factor into our assessment.

Within the broad-leaved forest, coniferous forest, and mixed forest type groups, we manually classified vegetation formations (secondary classification units under vegetation types) with known strong human influence (e.g., *Pinus massoniana*, *Cunninghamia lanceolata*, and *Platycladus orientalis* plantations, identified via *Vegetation of China*) as highly altered^{6,21}.

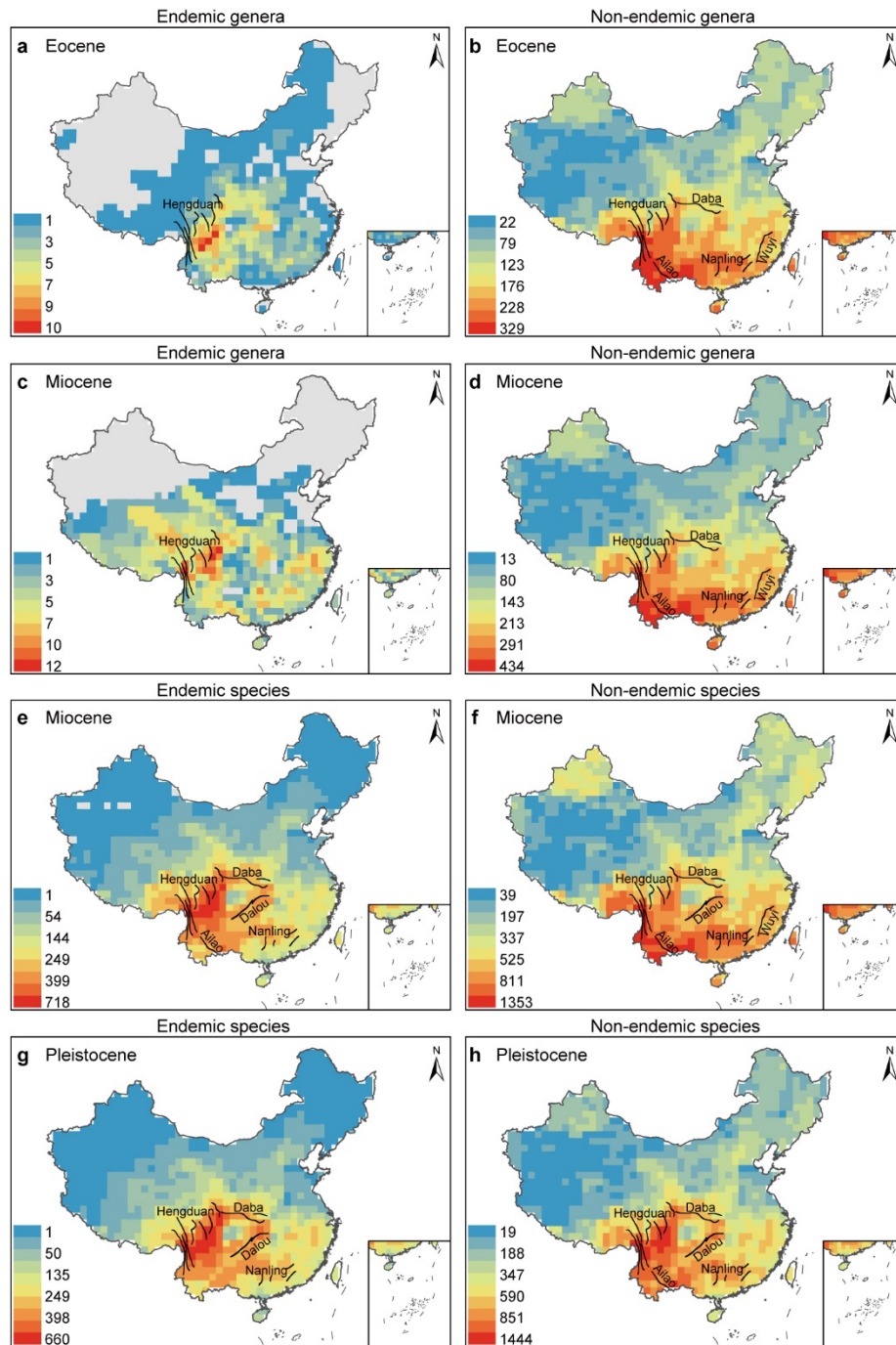
For the remaining formations, we spatially overlaid China's first high-resolution plantation map (1 km × 1 km, published in 2023, using multi-source remote sensing

and crowdsourced data) onto our vegetation map²³. This allowed us to quantify the proportion of plantations (classified as highly altered vegetation) versus natural forests (considered intact primary vegetation) within these formations.

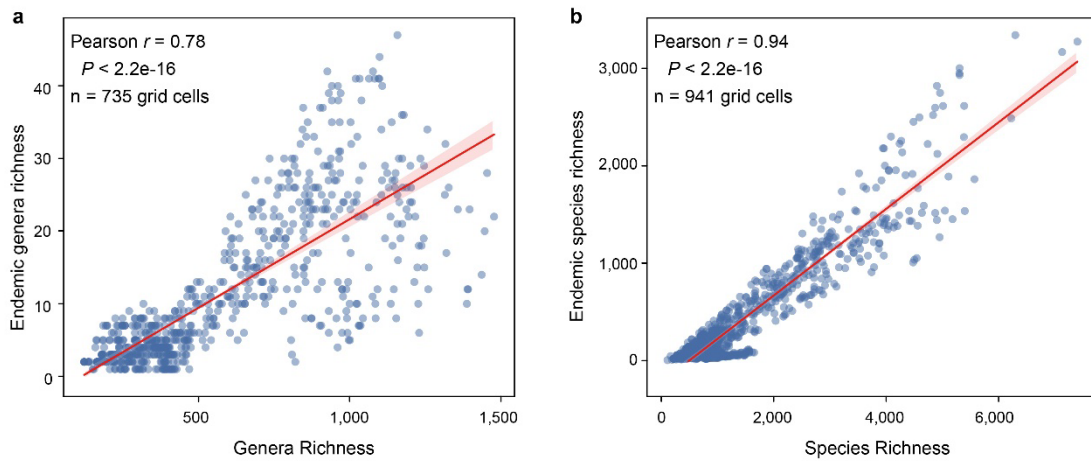
This assessment revealed that 93.1% of Central China's natural landscapes have been altered. Only 105,902 km² of intact primary vegetation remains, constituting less than 7% of the total area of Central China (Supplementary Table 7).



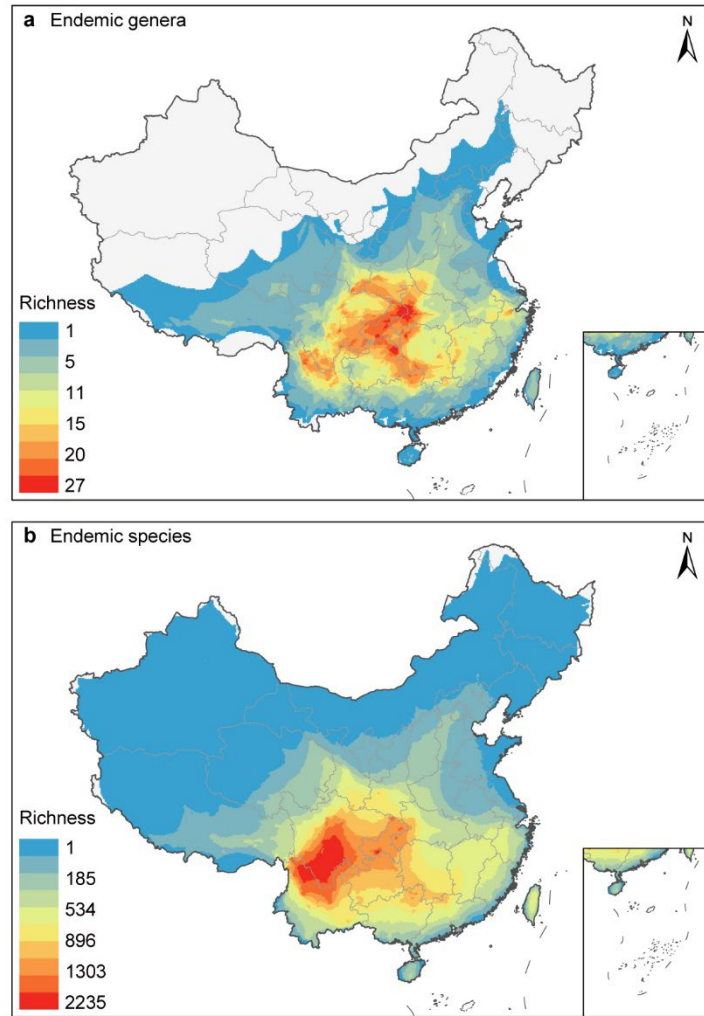
Supplementary Figure 1. Geographic distribution of molecular data gap for vascular plants in China. a, b, Richness of unsampled species and unsampled endemic species. c, d, Proportion of unsampled species to total species and unsampled endemic species to total endemic species. Review drawing number for maps: GS(2019)1823.



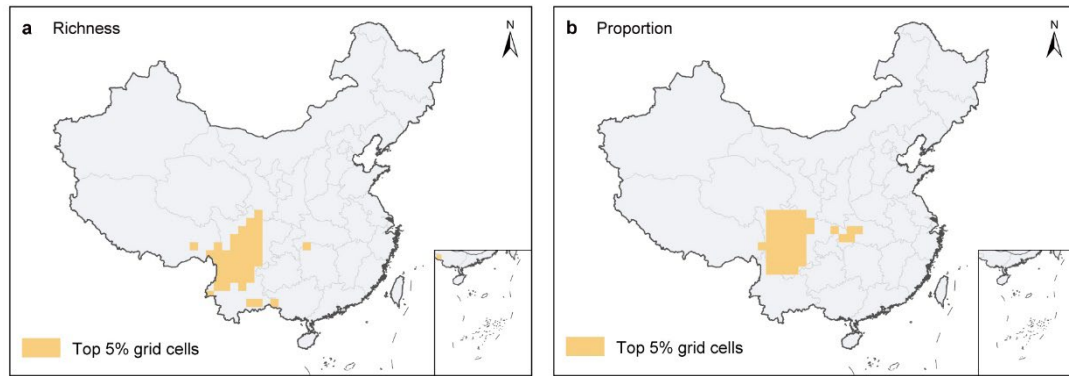
Supplementary Figure 2. Spatial richness of endemic and non-endemic genera and species originated during key geological periods in China. a-d, Richness of genera originated during the Eocene and Miocene, **e-h,** species originated during the Miocene and Pleistocene. Gray cells indicate the absence of China's endemic genera or species. Black lines depict major mountain ranges in areas of high richness. Review drawing number for maps: GS(2019)1823.



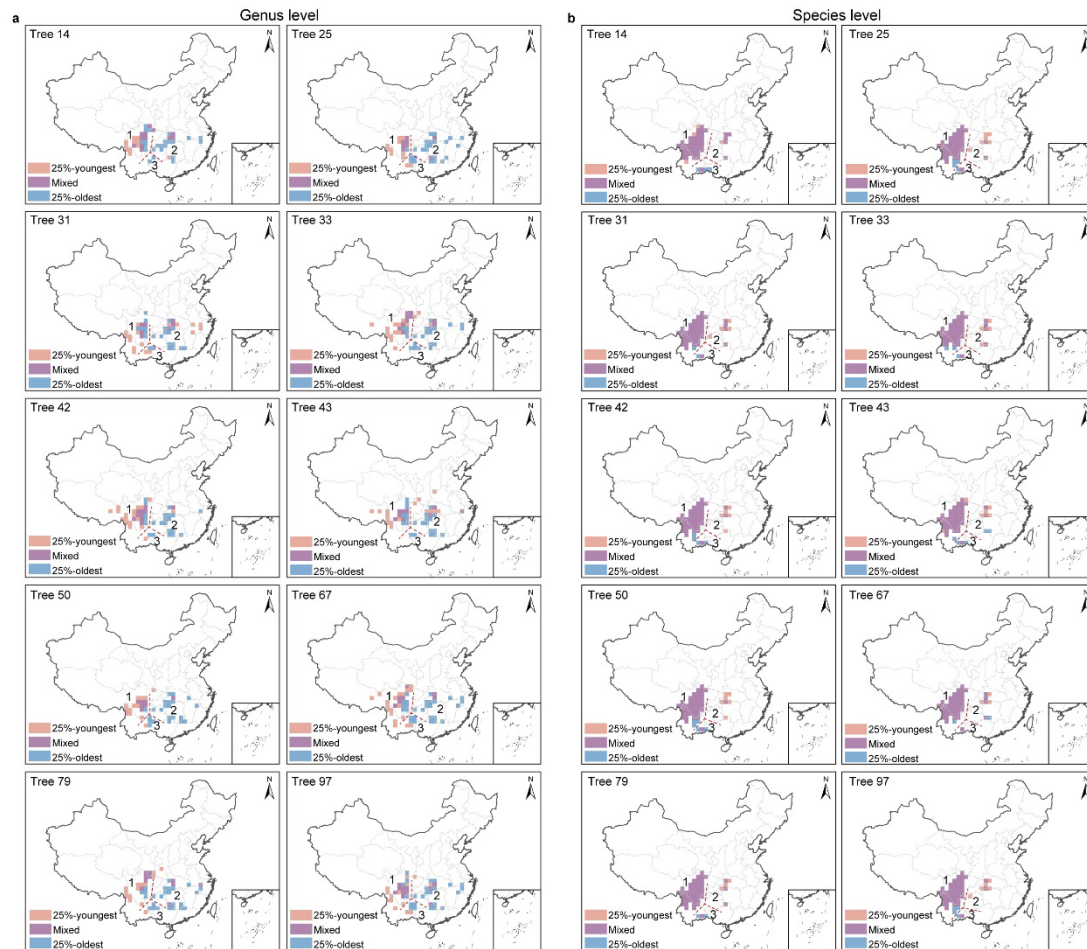
Supplementary Figure 3. Correlation between endemic and total vascular plant taxa richness in China. a, All genera and endemic genera. **b**, All species and endemic species. Pearson's correlation coefficient (r) was used to assess the linear relationship between variables, with statistical significance determined by a two-tailed P -value. A linear regression model was applied to visualize trends, with the fitted regression line representing the central tendency. The 95% confidence interval (CI) was displayed as a shaded area around the regression line.



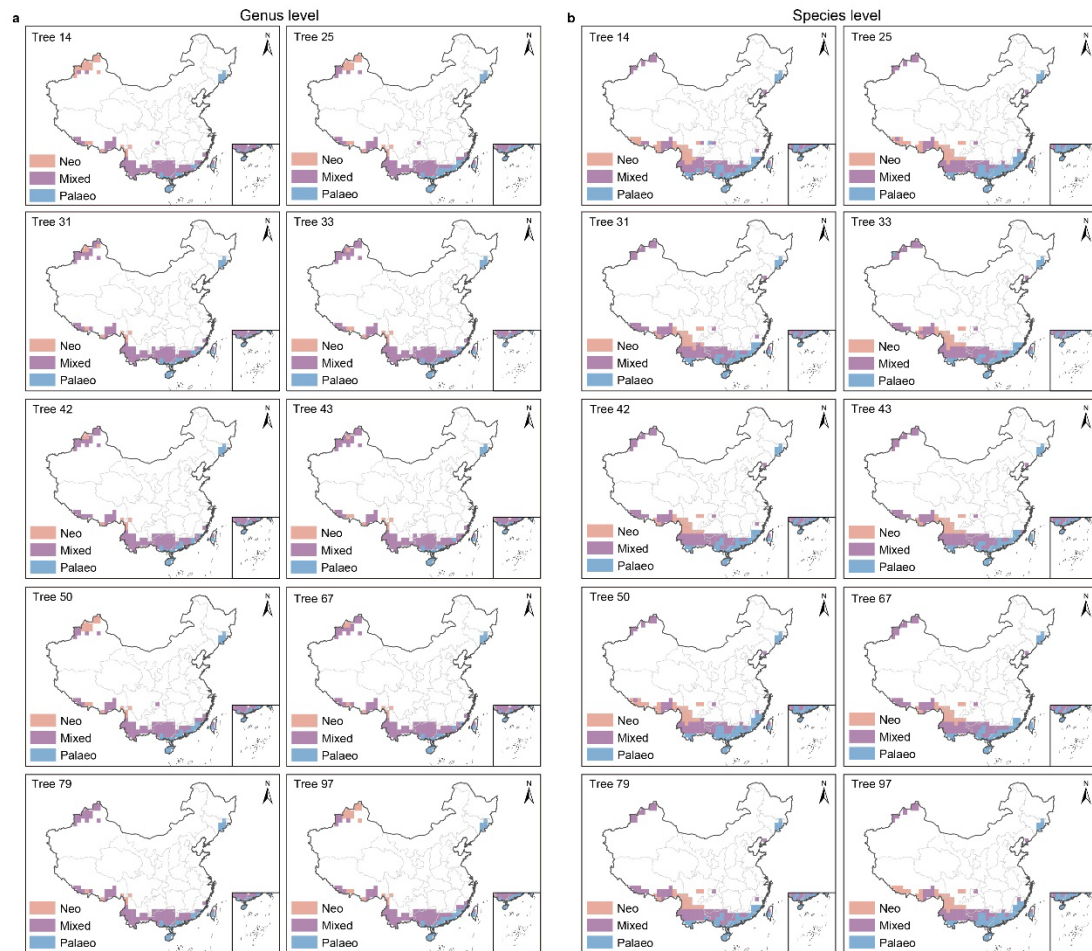
Supplementary Figure 4. Spatial distribution of richness of Chinese endemic vascular plant genera and species based on coordinate data. (a) Richness of endemic genera, (b) Richness of endemic species. Light gray cells indicate the absence of endemic genera or species. Review drawing number for maps: GS(2019)1823.



Supplementary Figure 5. Centres of taxonomic endemism based on the top 5% richness and endemic proportion of all endemic species. a, Grid cells with the top 5% richness of endemic species ($n = 13,724$). **b,** Grid cells with the top 5% proportion of endemic species. The proportion was calculated as the number of endemic species divided by the total number of species in each grid cell. Review drawing number for maps: GS(2019)1823.



Supplementary Figure 6. Geographic distribution of taxonomic endemism centres for vascular plants in China based on 10 randomly selected bootstrap trees. Taxonomic endemism centres based on the top 5% criterion at the genus (a) and species (b) levels: (1) the Hengduan Mountains, (2) Central China, and (3) Yunnan-Guizhou-Guangxi boundary region. Grid cells in pink represent centres of the youngest quartile, blue the oldest quartile, and purple mixed centres of the two types. The index of the specific bootstrap replicate (selected from 100 trees) is shown in the upper-left corner of each map. Review drawing number for maps: GS(2019)1823.



Supplementary Figure 7. Geographic distribution of phylogenetic endemism centres for vascular plants in China based on 10 randomly selected bootstrap trees. Phylogenetic endemism centres identified by the CANAPE analysis at the genus (a) and species (b) levels. Grid cells in pink represent centres of neo-endemism, blue centres of palaeo-endemism, and purple centres of mixed-endemism. The index of the specific bootstrap replicate (selected from 100 trees) is shown in the upper-left corner of each map. Review drawing number for maps: GS(2019)1823.



Supplementary Figure 8. Major vegetation regions in China. The black line indicates the proposed new biodiversity hotspot (Central China) in this study, while the orange line represents vegetation zones further divided within the subtropical evergreen broad-leaved forest region, including the northern and central subtropical zones. Review drawing number for maps: GS(2019)1823.

Supplementary Table 1. Number of vascular plant genera and species native to China, along with the number and proportion of endemic genera and species in China.

Group	Number of genera	Number of endemic genera (%)	Number of species	Number of endemic species (%)
Angiosperms	2,850	118 (4.1%)	28,715	15,009 (52.3%)
Gymnosperms	36	6 (17.1%)	201	94 (46.8%)
Ferns	168	0 (0.0%)	1,980	782 (39.5%)
Lycophytes	7	0 (0.0%)	143	57 (39.9%)
Total	3,061	124 (4.1%)	31,039	15,942 (51.4%)

Supplementary Table 2. Sampling number and percentage of total and endemic genera and species within major groups of Chinese vascular plants.

Group	Number of genera (%)	Number of endemic genera (%)	Number of species (%)	Number of endemic species (%)
Angiosperms	2,818 (98.9%)	111 (94.1%)	14,969 (52.1%)	5,835 (38.9%)
Gymnosperms	36 (100.0%)	6 (100.0%)	185 (92.0%)	80 (85.1%)
Ferns	168 (100.0%)	0 (0.0%)	1,323 (66.8%)	315 (40.3%)
Lycophytes	7 (100.0%)	0 (0.0%)	108 (75.5%)	35 (61.4%)
Total	3,029 (99.0%)	117 (94.4%)	16,585 (53.4%)	6,265 (39.3%)

Supplementary Table 3. Taxonomic status and current distribution (in China) of genera not sampled in this study.

Genus	Family	Group	Taxonomic status ^a	Endemism (Distribution) ^b	Reference
<i>Psilotrichopsis</i>	Amaranthaceae	Angiosperm	Accepted (1/1)	Non-endemic (Hainan)	
<i>Cenolophium</i>	Apiaceae	Angiosperm	Accepted (1/1)	Non-endemic (Xinjiang)	
<i>Chaerophyllopsis</i>	Apiaceae	Angiosperm	Accepted (1/1)	Endemic (Xizang, Yunnan)	
<i>Lithosciadium</i>	Apiaceae	Angiosperm	Accepted (1/2)	Non-endemic (Xinjiang)	
<i>Pleuropermopsis</i>	Apiaceae	Angiosperm	Accepted (2/2)	Non-endemic (Sichuan, Xizang, Yunnan)	
<i>Stenocoelium</i>	Apiaceae	Angiosperm	Accepted (2/4)	Non-endemic (Xinjiang)	
<i>Genianthus</i>	Apocynaceae	Angiosperm	Accepted (3/17)	Non-endemic (Yunnan, Guangxi)	
<i>Goniostemma</i>	Apocynaceae	Angiosperm	Accepted (1/2)	Non-endemic (Yunnan)	
<i>Ajaniopsis</i>	Asteraceae	Angiosperm	Accepted (1/1)	Endemic (Xizang)	
<i>Archiserratula</i>	Asteraceae	Angiosperm	Accepted (1/1)	Endemic (Yunnan)	
<i>Gnomophalium</i>	Asteraceae	Angiosperm	Accepted (1/1)	Non-endemic (Xizang)	
<i>Handelia</i>	Asteraceae	Angiosperm	Accepted (1/1)	Non-endemic (Xinjiang)	
<i>Rhopalocnemis</i>	Balanophoraceae	Angiosperm	Accepted (1/1)	Non-endemic (Yunnan, Guangxi)	
<i>Antiotrema</i>	Boraginaceae	Angiosperm	Accepted (1/1)	Endemic (Guangxi, Guizhou, Sichuan, Yunnan)	

<i>Craniospermum</i>	Boraginaceae	Angiosperm	Accepted (2/11)	Non-endemic (Xinjiang, Inner Mongolia)	
<i>Mattiastrum</i>	Boraginaceae	Angiosperm	Accepted (1/36)	Non-endemic (Xizang)	
<i>Pycnophilthopsis</i>	Brassicaceae	Angiosperm	Accepted (1/1)	Non-endemic (Xizang)	
<i>Corsiopsis</i>	Corsiaceae	Angiosperm	Accepted (1/1)	Endemic (Extinct)	Ref. ²⁴
<i>Gyrogyne</i>	Gesneriaceae	Angiosperm	Accepted (1/1)	Endemic (Extinct)	Ref. ²⁴
<i>Lophanthus</i>	Lamiaceae	Angiosperm	Accepted (4/20)	Non-endemic (Xinjiang, Xizang, Inner Mongolia)	
<i>Chamaeanthus</i>	Orchidaceae	Angiosperm	Accepted (1/1)	Non-endemic (Taiwan)	
<i>Cleisostomopsis</i>	Orchidaceae	Angiosperm	Accepted (1/5)	Non-endemic (Guangxi)	
<i>Didymoplexiella</i>	Orchidaceae	Angiosperm	Accepted (1/9)	Non-endemic (Hainan, Taiwan)	
<i>Didymoplexiopsis</i>	Orchidaceae	Angiosperm	Accepted (1/1)	Non-endemic (Hainan)	
<i>Saccolabiopsis</i>	Orchidaceae	Angiosperm	Accepted (2/14)	Non-endemic (Taiwan)	
<i>Sarcophyton</i>	Orchidaceae	Angiosperm	Accepted (1/3)	Non-endemic (Taiwan)	
<i>Stereosandra</i>	Orchidaceae	Angiosperm	Accepted (1/1)	Non-endemic (Yunnan, Taiwan)	
<i>Yoania</i>	Orchidaceae	Angiosperm	Accepted (1/5)	Non-endemic (Jiangxi, Fujian, Taiwan)	
<i>Petitmenginia</i>	Orobanchaceae	Angiosperm	Accepted (1/1)	Non-endemic (Yunnan)	
<i>Pseudosclerochloa</i>	Poaceae	Angiosperm	Accepted (1/2)	Non-endemic (Anhui, Henan, Jiangsu, Jiangxi)	
<i>Metanemone</i>	Ranunculaceae	Angiosperm	Accepted (1/1)	Endemic (Yunnan)	

<i>Nathaliella</i>	Scrophulariaceae	Angiosperm	Accepted (1/1)	Non-endemic (Xinjiang)	
<i>Kirilowia</i>	Amaranthaceae	Angiosperm	Synonym	Non-endemic (Xinjiang)	Ref. ²⁵
<i>Haplospondias</i>	Anacardiaceae	Angiosperm	Synonym	Non-endemic (Yunnan)	Ref. ²⁶
<i>Aphanopleura</i>	Apiaceae	Angiosperm	Synonym	Non-endemic (Xinjiang)	Ref. ²⁷
<i>Adelostemma</i>	Apocynaceae	Angiosperm	Synonym	Non-endemic (Guangxi, Guizhou, Yunnan)	Ref. ²⁸
<i>Belostemma</i>	Apocynaceae	Angiosperm	Synonym	Non-endemic (Yunnan, Sichuan)	Ref. ²⁹
<i>Sichuania</i>	Apocynaceae	Angiosperm	Synonym	Endemic (Sichuan)	Ref. ²⁸
<i>Diplazoptilon</i>	Asteraceae	Angiosperm	Synonym	Endemic (Yunnan, Xizang)	Ref. ³⁰
<i>Sinoleontopodium</i>	Asteraceae	Angiosperm	Synonym	Endemic (Xizang)	Ref. ³¹
<i>Turczaninovia</i>	Asteraceae	Angiosperm	Synonym	Non-endemic	Ref. ³²
<i>Drabopsis</i>	Brassicaceae	Angiosperm	Synonym	Non-endemic (Xinjiang)	Ref. ³³
<i>Sinosophiopsis</i>	Brassicaceae	Angiosperm	Synonym	Non-endemic (Sichuan, Xizang, Qinghai)	Ref. ³⁴
<i>Roureopsis</i>	Connaraceae	Angiosperm	Synonym	Non-endemic (Yunnan, Guangxi)	Ref. ³⁵
<i>Ohbaea</i>	Crassulaceae	Angiosperm	Synonym	Endemic (Yunnan, Sichuan)	Ref. ³⁶
<i>Anagallidium</i>	Gentianaceae	Angiosperm	Synonym	Non-endemic (Inner Mongolia)	Ref. ³⁷
<i>Cotylanthera</i>	Gentianaceae	Angiosperm	Synonym	Non-endemic (Sichuan, Xizang, Yunnan)	Ref. ³⁸

<i>Hemiboeopsis</i>	Gesneriaceae	Angiosperm	Synonym	Non-endemic (Yunnan)	Ref. ³⁹
<i>Paralagarosolen</i>	Gesneriaceae	Angiosperm	Synonym	Endemic (Guangxi)	Ref. ⁴⁰
<i>Trisepalum</i>	Gesneriaceae	Angiosperm	Synonym	Non-endemic (Yunnan, Sichuan)	Ref. ⁴¹
<i>Lianthus</i>	Hypericaceae	Angiosperm	Synonym	Endemic (Yunnan)	Ref. ⁴²
<i>Geniosporum</i>	Lamiaceae	Angiosperm	Synonym	Non-endemic (Yunnan, Hainan)	Ref. ⁴³
<i>Nosema</i>	Lamiaceae	Angiosperm	Synonym	Non-endemic (Guangdong, Guangxi, Hainan)	Ref. ⁴³
<i>Paradombeya</i>	Malvaceae	Angiosperm	Synonym	Endemic (Yunnan, Sichuan)	Ref. ⁴⁴
<i>Microtatorchis</i>	Orchidaceae	Angiosperm	Synonym	Non-endemic (Taiwan)	Ref. ⁴⁵
<i>Dendrocalamopsis</i>	Poaceae	Angiosperm	Synonym	Non-endemic (Southeast China)	Ref. ⁴⁶
<i>Keenania</i>	Rubiaceae	Angiosperm	Synonym	Non-endemic (Guangxi)	Ref. ⁴⁷
<i>Leptunis</i>	Rubiaceae	Angiosperm	Synonym	Non-endemic (Xinjiang)	Ref. ⁴⁸
<i>Craspedosorus</i>	Thelypteridaceae	Fern	Synonym	Endemic (Yunnan)	Ref. ⁴⁹
<i>Himalayopteris</i>	Polypodiaceae	Fern	Synonym	Non-endemic (Xizang)	Ref. ⁵⁰

^aFor accepted genera, the number of species native to China and global species number are given in parentheses. ^bDistribution data include only occurrences within China.

Supplementary Table 4. Number and percentage of total and endemic genera and species of vascular plants that diverged during each geological timespan.

Geological timespan	Number of genera (%)	Number of endemic genera (%)	Number of species (%)	Number of endemic species (%)
Pre-Jurassic	20 (0.7%)	1 (0.9%)	5 (0.0%)	1 (0.0%)
Jurassic	57 (1.9%)	1 (0.9%)	25 (0.2%)	3 (0.0%)
Cretaceous	479 (15.8%)	15 (12.8%)	246 (1.5%)	36 (0.6%)
Palaeocene	186 (6.1%)	8 (6.8%)	140 (0.8%)	34 (0.5%)
Eocene	627 (20.7%)	21 (18.0%)	645 (3.9%)	135 (2.2%)
Oligocene	551 (18.2%)	17 (14.5%)	1,037 (6.3%)	247 (3.9%)
Miocene	997 (32.9%)	44 (37.6%)	6,946 (41.9%)	2,386 (38.1%)
Pliocene	71 (2.3%)	6 (5.1%)	2,833 (17.1%)	1,163 (18.6%)
Pleistocene	41 (1.4%)	4 (3.4%)	4,707 (28.4%)	2,260 (36.1%)

Supplementary Table 5. Taxon diversity and endemism in three taxonomic endemism centres of China. The area and richness of each endemism centre was calculated from the total area of grid cells identified by the top 5% criterion (see Fig. 3a, b). Endemic genera and species listed refer specifically to taxa endemic to China.

Taxonomic endemism centre	Genus-level centre			Species-level centre		
	Area (km ²)	No. of genera	No. of endemic genera	Area (km ²)	No. of species	No. of endemic species
Hengduan Mountains	269,257	1,772	74	383,351	13,511	7,281
Central China	170,000	1,597	59	90,000	6,319	3,013
Yunnan-Guizhou-Guangxi boundary region	30,000	1,461	36	20,000	6,182	2,090

Supplementary Table 6. Recorded species diversity and endemism in Central China. Full lists of endemic vascular plants and vertebrates are provided in Supplementary Data 3 and 4, respectively. Endemism criterion: $\geq 90\%$ of distribution within Central China.

Taxonomic Group	Species	Endemic species	Percentage of endemism	Endemic genera	Endemic families
Vascular plants	14,431	2,024	14.0%	43	2
Mammals	205	21	10.2%	1	1
Birds	813	3	0.4%	0	0
Amphibians	246	124	50.4%	4	0
Reptiles	206	24	11.7%	1	0
Freshwater fishes	283	76	26.9%	2	0

Supplementary Table 7. Area and percentage coverage of land cover categories in Central China: primary native vegetation, highly altered vegetation, and cultural vegetation and non-vegetated area.

Category	Vegetation state	Area (km ²)	Percentage coverage
Primary native vegetation	Native vegetation structure, composition, and regenerative capacity intact; not significantly perturbed by land use/land management practice	105,902	6.9%
Highly altered vegetation	Native vegetation community structure, composition, and regenerative capacity significantly altered by land use/land management practice	795,386	51.6%
Cultural vegetation and non-vegetated area	Native vegetation replaced with cultivated vegetation and non-vegetated land cover (water)	640,672	41.5%
Total		1,541,960	100%

Supplementary Table 8. Protected area coverage in Central China across different protection levels.

Protection category	Area (km ²)	Percentage of total
National level protected area	32,881	2.1%
Provincial level protected area	33,691	2.2%
Prefectural and county level protected area	30,190	2.0%
National parks (and pilots)	6,089	0.4%
Unprotected	1,439,109	93.3%
Total	1,541,960	100%

Supplementary Table 9. Voucher information for 70 genera newly sampled in this study compared to Hu *et al.*¹. Herbarium codes follow voucher numbers. Plant images are available where conservation policies precluded collection.

Family (APG IV)	Genus	Voucher	Taxonomic status ^a	Phylogenetic position ^b	Reference
Acanthaceae	<i>Ophiorrhizophyllon</i>	CPG63062 (PE)	Synonym of <i>Staurogyne</i>		Ref. ⁵¹
Amaranthaceae	<i>Allmania</i>	CPG43832 (images)	Accepted name		
Amaranthaceae	<i>Arthropytum</i>	CPG73146 (PE)	Accepted name		
Amaranthaceae	<i>Baolia</i>	CPG41494 (PE)	Accepted name		
Amaranthaceae	<i>Stilbanthus</i>	CPG43833 (images)	Accepted name		
Amaranthaceae	<i>Trichuriella</i>	CPG41955 (PE)	Accepted name		
Anacardiaceae	<i>Terminthia</i>	CPG43831 (images)	Accepted name		
Apiaceae	<i>Czernaevia</i>	CPG74437 (PE)	Synonym of <i>Angelica</i>		Ref. ⁵²
Apiaceae	<i>Hyalolaena</i>	CPG73154 (PE)	Accepted name		
Apiaceae	<i>Oreocomopsis</i>	NCBI	Accepted name		
Apiaceae	<i>Phlojodicarpus</i>	CPG72346 (PE)	Accepted name		
Apiaceae	<i>Seselopsis</i>	CPG73162 (PE)	Accepted name		
Apiaceae	<i>Soranthus</i>	CPG71993 (PE)	Synonym of <i>Ferula</i>		Ref. ⁵³
Apiaceae	<i>Talassia</i>	NCBI	Synonym of <i>Ferula</i>		Ref. ⁵³
Apiaceae	<i>Zosima</i>	NCBI	Accepted name		
Apocynaceae	<i>Dischidanthus</i>	CPG42628 (images)	Accepted name		
Apocynaceae	<i>Dolichopetalum</i>	CPG43822 (images)	Accepted name		
Apocynaceae	<i>Lygisma</i>	CPG42353 (images)	Accepted name		
Apocynaceae	<i>Merrillanthus</i>	CPG42103 (PE)	Synonym of <i>Vincetoxicum</i>		Ref. ²⁹

Apocynaceae	<i>Pentastelma</i>	CPG43823 (images)	Synonym of <i>Vincetoxicum</i>		Ref. ²⁹
Asteraceae	<i>Arctogeron</i>	CPG73678 (PE)	Synonym of <i>Aster</i>		Ref. ³²
Asteraceae	<i>Dicercocladus</i>	CPG43825 (images)	Accepted name		
Asteraceae	<i>Epilasia</i>	CPG72093 (PE)	Accepted name		
Asteraceae	<i>Hainanecio</i>	CPG42320 (images)	Accepted name		
Asteraceae	<i>Heteroplexis</i>	CPG43826 (images)	Synonym of <i>Aster</i>		Ref. ⁵⁴
Asteraceae	<i>Rhinactinidia</i>	CPG73042 (PE)	Synonym of <i>Aster</i>		Ref. ³²
Asteraceae	<i>Richteria</i>	CPG72200 (PE)	Accepted name		
Asteraceae	<i>Sonchella</i>	NCBI	Accepted name		
Asteraceae	<i>Stilpnolepis</i>	NCBI	Accepted name		
Boraginaceae	<i>Heterocaryum</i>	CPG72227 (PE)	Accepted name		
Boraginaceae	<i>Rindera</i>	CPG72660 (PE)	Accepted name		
Boraginaceae	<i>Rotula</i>	NCBI	Synonym of <i>Ehretia</i>		Ref. ⁵⁵
Brassicaceae	<i>Atelanthera</i>	NCBI	Accepted name		
Brassicaceae	<i>Dipoma</i>	NCBI	Accepted name	Incongruent, not supported Hemilophiaeae(<i>Dipoma</i> + <i>Hemilophia</i>)	Ref. ^{56,57}
Brassicaceae	<i>Hemilophia</i>	CPG73497 (PE)	Accepted name	Incongruent, not supported Hemilophiaeae(<i>Dipoma</i> + <i>Hemilophia</i>)	Ref. ^{56,57}
Brassicaceae	<i>Lepidostemon</i>	NCBI	Accepted name		
Brassicaceae	<i>Macropodium</i>	CPG72709 (PE)	Accepted name	Incongruent, basal of Brassicaceae, not included in Stevenieae	Ref. ⁵⁸

Brassicaceae	<i>Pseudoclausia</i>	NCBI	Synonym of <i>Parrya</i>	Incongruent, not included in <i>Parrya</i>	Ref. ^{59,60}
Caryophyllaceae	<i>Pseudocerastium</i>	NCBI	Synonym of <i>Cerastium</i>		Ref. ⁶¹
Commelinaceae	<i>Dictyospermum</i>	CPG42948 (images)	Accepted name		
Crassulaceae	<i>Kungia</i>	CPG41473 (PE)	Accepted name		
Ericaceae	<i>Monotropastrum</i>	CPG09922 (PE)	Accepted name		
Euphorbiaceae	<i>Falconeria</i>	CPG41982 (PE)	Accepted name		
Euphorbiaceae	<i>Megistostigma</i>	CPG71911 (PE)	Accepted name		
Euphorbiaceae	<i>Pachystylidium</i>	NCBI	Accepted name		
Fabaceae	<i>Urariopsis</i>	CPG43821 (images)	Accepted name		
Gentianaceae	<i>Latouchea</i>	CPG43827 (images)	Accepted name		
Gesneriaceae	<i>Cathayanthe</i>	CPG41926 (PE)	Accepted name		
Gesneriaceae	<i>Leptoboea</i>	NCBI	Accepted name		
Gesneriaceae	<i>Metapetrocosmea</i>	CPG42059 (PE)	Accepted name		
Lamiaceae	<i>Acrocephalus</i>	CPG43818 (images)	Synonym of <i>Platostoma</i>		Ref. ⁴³
Lamiaceae	<i>Metastachydium</i>	CPG72121 (PE)	Synonym of <i>Phlomoides</i>		Ref. ⁶²
Lamiaceae	<i>Paralamium</i>	CPG43820 (images)	Accepted name		
Malvaceae	<i>Cenocentrum</i>	NCBI	Accepted name		
Mitrastemonaceae	<i>Mitrastemon</i>	CPG43828 (images)	Accepted name	Incongruent, nested within Monotropoideae (Ericaceae)	
Orchidaceae	<i>Diplandrorchis</i>	NCBI	Synonym of <i>Neottia</i>		Ref. ⁶³
Orchidaceae	<i>Ischnogyne</i>	NCBI	Accepted name		
Orchidaceae	<i>Myrmechis</i>	NCBI	Synonym of <i>Odontochilus</i>		Ref. ⁶⁴

Orobanchaceae	<i>Christisonia</i>	NCBI	Accepted name
Orobanchaceae	<i>Leptorhabdos</i>	CPG73142 (PE)	Accepted name
Orobanchaceae	<i>Pseudobartsia</i>	NCBI	Accepted name
Phrymaceae	<i>Cyrtandromoea</i>	NCBI	Accepted name
Phrymaceae	<i>Mimulicalyx</i>	NCBI	Accepted name
Poaceae	× <i>Agropogon</i>	NCBI	Accepted name
Rubiaceae	<i>Alleizettella</i>	NCBI	Accepted name
Rubiaceae	<i>Dentella</i>	CPG42060 (PE)	Accepted name
Rubiaceae	<i>Microphysa</i>	CPG73032 (PE)	Accepted name
Rubiaceae	<i>Pseudopyxis</i>	NCBI	Accepted name
Scrophulariaceae	<i>Pentacoelium</i>	CPG42108 (PE)	Accepted name
Styracaceae	<i>Parastyrax</i>	NCBI	Accepted name

^aTaxonomic status is based on the latest literature (see “Reference” column for details);

^bPhylogenetic position demonstrates inconsistent phylogenetic placements between this research and other recent studies.

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